

**Intensification of maize-legume based systems in the semi-arid**

**areas of Tanzania (Kongwa and Kiteto districts) to increase farm**

**productivity and improves farming natural resource base**  
  
  
  
**Africa RISING East and Southern Africa**

Research Proposal 2012/2013

Tanzania – Kongwa and Kiteto  
  
  
  
  
  
  
  
  
**Lead Institution**International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

**Principal Investigator**

Dr Patrick Okori, Principal Scientist (Plant Breeding) ICRISAT Malawi

**Implementing Partners**

CIMMYT

ICRAF

ARI Hombolo

ARI Naliendele

Sokoine University of Agriculture

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| **Project Title**: | **Intensification of maize-legume based systems in the semi-arid areas of Tanzania to increase farm productivity and improves farming natural resource base** |
| **Grant Agency** | AFRICA RISING: Africa RISING East and Southern Africa Research Action-IITA |
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| **Country** | Tanzania – Kongwa and Kiteto Districts |
| **Principal Investigator** | Dr Patrick Okori, Principal Scientist (Plant Breeding) ICRISAT Malawi |
| **Implementing Partners**  (National Agricultural Research System, Universities and other Research Organizations) | CIMMYT  ICRAF  ARI Hombolo  ARI Naliendele  Sokoine University of Agriculture  University of Dodoma |
| **Development Partners** | NAFAKA |
| **Period of activity** | 1 year |
| **Amount requested** | **$ 500, 220** for one year |

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# SUMMARY

This proposal is a follow up of activities initially conducted in 2011- 2012 as part of the Africa RISING activities in Tanzania targeting the districts of Kongwa and Kiteto. Based on lessons learnt, we now propose wider and intensified activities that will harness on-farm adoptive and developmental research collaboration between researchers from the CGIAR Centers and the NARS. This effort will enhance access to, as well as use of technologies by smallholder farmers to improve their productivity and livelihoods. We seek to achieve two outcomes that speak to the program research and development outcomes. Our specific action project outcomes are (**a**) Increased productivity of maize and legume -based cropping systems with yield increases of up to 100% and 80% for maize and pigeon pea respectively ameliorate food security and nutrition security and poverty; (**b**) Improved land productivity (greater returns to investments, labour productivity and per unit outputs) and ecosystem management lead to sustainable resilient and productive farming and cropping systems in project action areas. Both Project outcomes will contribute to the Programme objectives 1, 2 and 3 on evaluation and promotion of demand-driven options for sustainable intensification, scaling-up delivery and maintaining or improving ecosystem stability. Actions are clustered into seven work packages for coherence and better delivery. The 7 work packages include: (i) On-farm evaluation of improved legume and cereals varieties for promotional activities, (ii) Integrated soil fertility management in action areas, (iii) Land management (soil and water conservation), (iv) Post harvest processing, utilization and nutrition, (v) Crop livestock and poultry integration and productivity enhancement, (ix) Characterization of Africa RISING sites and (vii) Lesson learning, networking and coordination. The activities will build on efforts by NAFAKA.

# 1. DESCRIPTION OF INTENDED WORK PLAN

## 1.1 The problem

Agriculture is a fundamental part of Tanzania’s economy. In 2010, Tanzania signed the Comprehensive Africa Agricultural Development Strategy Compact signaling commitment to agricultural development as the vehicle for transformation of the country’s agriculture (URT, 2010[[1]](#footnote-1)). Today, Tanzania is implementing the Agricultural Sector Development Programme (ASDP) in the mainland and the Agricultural Strategic Plan (ASP) in Zanzibar as home-grown, decentralized, community-led initiatives developed through rigorous multi-stakeholder consultative processes. According to the ASDP, about 80 % of the poor people in Tanzania live in rural areas with agriculture accounting for 75% of rural household incomes. Thus significant reductions in overall poverty levels, particularly rural poverty, in Tanzania will require raising agricultural incomes.

Key constraints to achieving Tanzania’s agricultural growth targets include among others,

1. Under-investment in productivity enhancing technologies.
2. Limited access to technology demand and delivery channels – with 60-75% of households estimated to have no contact with research and extension services;
3. Limited access to financing for the uptake of technologies;
4. Un-managed risks with significant exposure to variability in weather patterns with periodic droughts. The impact of these events is amplified by the dependency on rain fed agriculture and the limited capacity to manage land and water resources;

Box 1. Key constraints to increasing productivity in Tanzania agriculture (ASDP, 2005[[2]](#footnote-2))

In semiarid zones of Tanzania some of the major challenges to increased agricultural productivity include:

1. **Low productivity of crops and livestock sub sectors**. People living in arid and semi-arid regions that depend exclusively on livestock and food crop production.
2. **Fragility of production to market systems**. Their systems are fragile systems and therefore without interventions cannot support high levels of crops and livestock production.
3. **Vulnerability of communities**. High vulnerability of communities living in such communities to weather and other natural disaster related challenges. The people of the central and northern highlands are nutritionally the most deficient; register the severest levels of poverty (IFAD[[3]](#footnote-3), 2001).
4. **High levels of poverty**: The incidence of poverty varies greatly across the country, but is highest among rural families. Studies show that Dodoma among the semi-arid zones of Tanzania has one of the highest percentage of people living below the food poverty line at 35.5% and up to 51.4% based on expenditures[[4]](#footnote-4)

This proposed on-farm adoptive and developmental research collaboration between researchers from the CGIAR Centers and the NARS, will contribute to enhanced access to and utilization of low-cost technologies by poor smallholder farmers of Tanzania to improve their productivity. It is based upon an understanding of the physical, economic and social barriers that reduce the effectiveness of smallholder farmers to adopt or adapt improved farming technologies. It offers candidate solutions in a stepwise, iterative manner that will lead to improved food security, better nutrition and environment integrity. It relies heavily on the wider cultivation of recently improved crop cultivars developed for their multiple benefits of food, feed, energy, resilience of production systems and minimizing degradation, but remain under-utilized. The project depends on both improved technologies and integration of nutrition information that link farming and marketing practices to nutrition and health outcomes of vulnerable populations. Increased value addition, income from marketing and other related activities contributes to nutritional status by allowing a diversification of diets with on-farm and purchased foods. The complementarity of cereals and grain legumes and the integration of livestock will all contribute to a balanced household diet and diversified livelihood strategies. To this end, methods of eliminating the need for emergency food, malnutrition and relief effort in semi-arid zones of Kongwa and Kiteto Districts in Tanzania during 2012/2013 cropping season would be mainly through increased farm productivity that are underpinned by sustainable intensification principles. The proposed project seeks to introduce promising early and drought tolerant maize varieties, inorganic/ organic fertilizers and legume crops that enhance Biological Nitrogen Fixations (BNF) among others, as a strategy for yield enhancement, soil fertility improvement and ecosystem stability.

## 1.2 Intended outcomes and underlying assumptions for their achievement

### 1.2.1 Intended outcomes

1. **Outcome 1.** Increased crop yields in maize -based farming systems by up to 100% for cereals and 80% for legumes in semi-arid zones of Tanzania. This will lead to enhanced opportunities to address food security, nutrition and poverty challenges. This outcome will contribute to the programme objective 2 on Integrated systems improvement
2. **Outcome 2.** Improved land productivity (greater returns to investments, labour productivity and per unit outputs) in target areas of operation lead to more resilient, robust agro-ecologies and productive farming and crop systems of communities in semi-arid zones of Tanzania. This outcome will contribute to the programme objective 2 and 3 on integrated systems improvement and Scaling and delivery respectively.

### 1.2.2 Assumptions

1. Opportunities to improve access to improved seed and related technologies by majority of farming communities in semi-arid areas of Tanzania are optimal to support intensification efforts in target areas.
2. Farmer organisations and institutions are functional and committed to the project actions, especially in scaling up and out activities, in target districts.
3. Tanzanian government policy remain supportive for investing in agricultural growth in Tanzania and the target regions overall.
4. National partners continue providing adequate country ownership and support for smooth implementation of Africa Rising interventions.
5. Existing tenure systems allows for farm/plot to landscape level interventions in target communities.

# 2. RESEARCH HYPOTHESES TO BE ADDRESSED, DELIVERABLES

## 2.1 Research hypothesis

1. Introduction of early and intermediate maturing drought tolerant varieties of maize and grain legumes in semi-arid areas of Tanzania will improve crop productivity and ultimately enhance household food security, nutrition and income.
2. Adoption of soil moisture conservation technologies in drought prone areas of Tanzania will reduce crop failure and improve overall productivity.
3. Adoption of integrated soils fertility management technologies will improve soils fertility status and hence increased crop productivity.
4. Integrated approaches to sustainable intensification provide better options to strengthen livelihoods strategies of farmers in semi-arid areas of Tanzania than the currently used non- cohesive farming practices.

## 2.2 Research deliverables

1. **Output 1. Introduce and evaluate improved varieties of maize and grain legumes.** The focus shall be to validate and disseminate best-bet management packages around the most promising new crop varieties suited to semiarid agro-ecological zones. This output will contribute to outcome 1 of our intervention and objective 2 of the Africa RISING Programme.
2. **Output 2. Evaluate integrated soil fertility management options to improve plant nutrition and yields of crops and enhance agro-ecosystem resilience in action areas**. The focus will be on developing scenarios for sustainable production of identified crop varieties that contribute to sustainable agricultural resource management and offer nutritional and marketing advantages. This output will contribute to outcome 2 of our intervention and objective 2 of the Africa RISING programme.
3. **Output 3**. **Validate and promote** **land management options for sustainable agricultural intensification (soil and water conservation) in action areas**. This output will validate and promote economically viable and socially acceptable innovations that maintain and enhance production, reduce the level of crop production risk, conserve natural resources and prevent degradation of soil and foster agricultural biodiversity through the introduction of physical and biological measures. This objective will contribute to outcome 2 of our intervention and objective 2 of the programme.
4. **Output 4. Post-harvest processing and utilization.** This objective will contribute to improving household food and nutrition securityamong the most vulnerable households and their members, especially women and children. Special effort shall be made available to women farmers as technical innovators, resource managers and homemakers. This objective will contribute to outcome 1 of our intervention and objective 2 of the programme.
5. **Output 5**. **Crop- livestock (cattle, small ruminants/poultry) integration and productivity enhancement.** This objective will contribute to improving household food and nutrition security among the most vulnerable households; this objective will contribute to outcome 1and 2 of our intervention and objective 2 and 3 of the programme.

# 3. APPROACH: DESCRIPTION OF WORK PACKAGES

## 3.1 Work package 1. On-farm evaluation of improved legume and cereals varieties

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| **Work package number** | **WP 1** | **Start date or starting event:** | | | | | November 2012 to September 2013 | |
| **Work package title** | On-farm evaluation of improved legume and cereals varieties | | | | | | | |
| **Activity Type** | Action research, capacity building for farmers and extension staff | | | | | | | |
| **Target areas (Districts- Villages** | Chitego | | Laikala | Mlali | Moleti | Njoro | |  |
| **WP leader** | ICRISAT | | | | | | | |
| **Partners** | ARI-Hombolo | | NAFAKA | CIMMYT | SUA | ARI-Naliendele, | | SARI |
| **WP budget** | 123, 609 | | | | | | | |

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| **Relevant Africa Rising Objective 2: Integrated systems improvement** |
| **Key intervention areas:**  Introduce and evaluate improved varieties of maize and grain legume crops to farm households in a manner that complements their on-going farm enterprises and improves their productivity |

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| **Description of work**  **Task 1.1.** **Community mobilization for the action.** The aim of this activity is to prepare the communities in the two districts to engage in the action. The following activities will be done.  **Sub task 1.1.1** **Farmer and site selection.** Farmers willing to provide land for trials will be selected with help of village extension officer, village leadership NAFAKA, DALDOs and ARI Hombolo following general sensitization in target villages. Gender dimensions for soils and water management including impacts of land tenure on adoption of the proposed technologies will be part of each implementation.  **Task 1.2. Description of experiments -Maize**  **Subtask 1.2.1. Maize**. The aim is to evaluate the performance of stress tolerant maize varieties under farmer field conditions for adaptation. Six new early and intermediate maturity drought tolerant and two locally available maize varieties will be evaluated using mother-baby trial approach. The mother trial (8 varieties) will be established at 10 locations; each mother trial will have five (5) baby trials (4 varieties) in the neighboring farmer’s plots. The mother trials will be researcher managed while the baby trials will be under farmer management. Data on yield and farmer preference will be collected and used to inform adoption strategies.  **Quality Protein Maize (QPM) Variety Demonstration -** QPM has been developed to reduce human malnutrition in areas where protein deficiency is prevalent and maize is the major source of protein in the diet. Breeding efforts have led to the development and release of QPM varieties that have been released in Tanzania. Farmers in the target area have not been exposed to these varieties. The objective of this work is to test the adaptability of these varieties under farmer managed conditions. The three released varieties (Lishe K1, Lishe H1 and TANH611) and one farmer preferred variety will be planted in on-farm demo plots at five (5) locations. The plot sizes will be 10 m x 10 m. Farmer assessment of the varieties will be carried out at harvest.  **Task 1. 2**. **Description of experiments-legumes**  **Sub-task** **1.2.1** **Pigeonpea**. The aim is to evaluate performance of improved pigeon pea varieties under farmer field conditions for adaptation (yield, resilience to pests, diseases and drought and farmer preference etc.). Three pigeon pea varieties will be evaluated using participatory variety selection approaches at few representative locations. Large number of demonstrations will be conducted in each target village involving released variety (Mali-ICEAP 00040) material is mainly for grain but may perform other agro forestry needs, along with local varieties grown by farmers. Data will be collected and used to inform adoption and promotion strategies for the improved pigeon pea varieties. Strategic partnerships with NAFAKA farmers will be used in demonstration.  **Sub-task 1.2.2. Groundnuts**. The aim is to evaluate performance of improved groundnut varieties under farmer field conditions for adaptation (yield, resilience to rosette and drought and farmer preference etc.). Three new varieties will be evaluated using participatory variety selection approaches. Data will be collected and used to inform adoption and promotion strategies for the promising improved groundnut varieties. Strategic partnerships with NAFAKA farmers will be used in demonstration.  **Task 1.2.3 Pilot seed production for groundnuts and pigeonpea at community level.** In collaboration with NAFAKA identify farmers to develop and pilot a community based seed production in target areas through Quality Declared Seed (QDS) Production Model.ICRISAT will backstop the process. |
| **Deliverables**  There are four deliverables under this work package i.e.   1. At least two adapted varieties of maize identified for target areas 2. At least two adapted varieties of pigeonpea identified for target areas 3. At least two adapted varieties of groundnuts identified for target areas 4. Strategies for community based seed production piloted and validated for up-scaling |

## Work package 2. Integrated soil fertility management in action areas

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| **Work package number** | **WP 2** | **Start date or starting event:** | | | November 2012 to September 2013 | | |
| **Work package title** | Integrated soil fertility management in action areas | | | | | | |
| **Activity Type** | Action research type, R&T, participatory and promotional action | | | | | | |
| **Target areas (Districts- Villages** |  |  | Mlali | Moleti | Njoro |  |  |
| **WP leader** | ICRAF | | | | | | |
| Partners | ARI-Hombolo |  | SUA |  | ICRISAT |  | |
| **WP budget (USD)** | 50, 222 | | | | | | |

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| **Relevant Africa Rising Objective: Objective 3 on Scaling up and delivery** |
| **Key intervention areas:**   1. Develop scenarios for sustainable production of identified crop varieties that contribute to sustainable agricultural resource management and offer nutritional and marketing advantages. 2. Validate and disseminate best-bet management packages around the most promising new crop varieties suited to widely representative agro-ecological zones. |

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| **Description of work**  **Task 2.1.** **Community mobilization for the action.** The aim of this activity is to prepare the communities in the two districts to engage in the action. The following activities will be done.  **Sub task 2.1.1** **Farmer and site selection.** Farmers willing to provide land for trials will be selected with help of village leadership, DALDOs and ARI following general sensitization in target villages. Gender dimensions as they relate to this WP will be considered at this stage and throughout implementation.  **Task 2.2 Targeting fertilizer and manure applications**. The aim of the WP is address the problem of applying blanket fertilizer rates, which are often ineffective in overcoming nutrient limitations to crops growth. Overall, recent work by ICRAF (Kimaro et al., 2012[[5]](#footnote-5)) and NAFAKA in Kongwa and Kiteto indicated low levels of nitrogen, phosphorus and carbon, and marginal to high levels of other macro and micronutrients in the soil. Hence fertilizer trials will be conducted in selected sites to develop N & P fertilizer recommendations and assess effective P fertilizer type in the study sites. Similarly experiments to evaluate manure application rates will be established to guide the design of manure x fertilizer interactions, baby trials and up scaling options in sub-sequent years. The aim will be to evaluate the potential for locally available nutrient sources to minimize inputs of industrial fertilizers without compromising crops yields as an entry point to promote fertilizer use. Vector analysis techniques (Isaac and Kimaro, 2011[[6]](#footnote-6)) will be employed to diagnose and rank response to fertilizer (N&P) and manure applications. Improved varieties of maize and pigeon pea will be used as test crops.  ***Experimental design and treatments***: The randomized complete block design (RCBD) with the replications will be adopted for all fertilizer and manure trials. Mother plots for these trials will be established in 3 sites: Moleti and Mlali villages in Kongwa districts, and Njoro village in Kiteto district. For the N-rates, treatments will be control (no fertilizer), 20, 40, 60, 80 and 120 kg N/ha. Treatments for P-fertilizer rates will be control (no fertilizer), 15, 30, 45, 60 kg P/ha and for the effective source of P experiment will be: control (no fertilizer), TSP, Minjingu mazao and Minjingu rock phosphate applied at a rate of 30 kg P/ha. The manure trial will have the following treatments: control (no manure), 2.5, 5, 10, 15, and 20 kg-manure/ha. Application rates of N and P were selected to allow the development of response curves for identifying the optimum N&P rates based on initial soil analysis conducted by NAFAKA. Manures rates reflect the current rates used in Tanzania and Sub-Saharan Africa (Mafongoya et al. 2006[[7]](#footnote-7); Kimaro et al. 2009). The basal rate of N (40 kg N/ha) will be applied to the P-fertilizer trials and basal P (15 kg P/ha) for the N-fertilizer trials so as to minimize the confounding effects of very low levels of these elements in the soil as reported in NAFAKA soil survey report of 2012 and by Kimaro et al. (2012). Details of the experimental management, data collection, and statistical analysis can be found in the field protocol developed separately for implementation of this project.  **Sub task 2.2 Evaluation of Tree/shrub intercropping technologies as part of ISFM**. This will involve growing of more than one crop simultaneously on the same piece of land notably cereals and legume plant to fully exploit ecological benefits such as efficient use of growing space, nutrients, higher total yields and farm diversification to minimize the risk of total crop failure common in semi-arid zones. Pigeonpea and other leguminous tree/shurbs when appropriately integrated on-farm can act as nutrient pump to recycle nutrients that would have leached into deeper horizons. Pigeonpea is particularly considered compatible to cereals even in dry environments because the inherently slow growth relative to most cereals provides temporal complementarity in resource use and minimize interspecific competition under intercropping (Snapp et al., 2002[[8]](#footnote-8); Kamaro et al 2009[[9]](#footnote-9)). Thus clear understanding of spatial arrangements of interacting plants in mixtures is a critical agronomic practice influencing the benefits arising from the balance between positive (facilitative and complementarity) interactions and negative (competitive) interactions in intercropping (Kimaro et al., 2009). This WP therefore will evaluate appropriate spatial arrangements (Alternate within a row, single alternate row and double alternate row) needed for intercropping the introduced maize and legume verities in Kongwa and Kiteto. The focal crops will be maize, and pigeonpea. Various techniques such as vector competition analysis (Kimaro et al., 2009; Isaac and Kimaro, 2011) and the Land Equivalent Ratio (Vandermeer, 1989[[10]](#footnote-10)) will be adopted to assess ecological interactions in mixture to guide recommendations on spatial arrangements.  Options for integrating other trees/shrubs for soil fertility and erosion control will be explored in sub-sequent years based on the results of initial work conducted under WP 5. These will include interventions like using less palatable tree/shrubs species (e.g., *Gliricidia sepium* and *Tephrosia vogelii*) to establish windbreaks, one-year fallows and/or stabilizing contours and ridges in selected areas.  ***Experimental design and treatments***: This experiment will be laid out in a RCBD with three replications. The following treatments will be adopted for this study:   * Treatment 1: Alternating maize and pigeonpea plants within a row * Treatment 3: One row of maize alternating with one row of pigeonpea. * Treatment 3: One row of maize alternating with double rows of pigeonpea * Treatment 4: Maize monoculture * Treatment 5: Pigeonpea monoculture   **Sub task. 2.3 Cost benefits analyses.** This will be done to support promotional activities. It will also include design of practical measures to support use of tested ISFM technologies. This task will be led by a socio-economist from ICRISAT. |
| **Deliverables**   1. Farmers exposed and encouraged to adopt the tested ISFM technologies during field days and other mobilization campaigns 2. Experiments to test the appropriate application rates of N&P fertilizers and cattle manure initiated and used to guide the design of interventions in baby trials in sub-sequent years. 3. Options for spatial integration of pigeopea and maize to improve soil fertility and crops yields tested and repeated in subsequent years for validation and up and out-scaling. 4. Appropriate source of P for maize and pigeonpea production in targeted sites evaluated and promoted for adoption in baby trials. 5. Train one M.Sc. student at SUA by support the research component. |

## Work package 3. Land management (soil and water conservation) in action areas

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| **Work package number** | **WP 3** | **Start date or starting event:** | | | November, 2012 to September 2013 |
| **Work package title** | Land management (soil and water conservation) in action areas | | | | |
| **Activity Type** | Action research type, R&T, participatory and promotional action | | | | |
| **Target areas (Districts- Villages** | Chitego | Laikala | Mlali | Moleti | Njoro |
| **WP leader** | ARI-Hombolo | | | | |
| **Partners** | ICRAF | NAFAKA | SUA | IRA | ICRISAT |
| **WP budget** | 37,360 | | | | |

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| **Relevant Africa Rising Objective: Objective 3 on Scaling up and delivery** |
| **Key intervention areas:**   1. **Best bets**. Develop scenarios for sustainable production of identified crop varieties (Step 2) that contribute to sustainable agricultural resource management and offer nutritional and marketing advantages 2. **Resource conservation**. Protect land and water resources and foster agricultural biodiversity through the introduction and management of physical and biological measures |

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| **Description of work**  **Task 3.1.** **Community mobilization for the action.** The aim of this activity is to prepare the communities in the two districts to engage in the action. The following activities will be done.  **Sub task 3.1.1** **Farmer and site selection.** Farmers willing to provide land for trials will be selected with help of village leadership NAFAKA, DALDOs and ARI following general sensitization for erosion control in target villages. Gender dimensions for soils and water management including impacts of land tenure on adoption of the proposed technologies will be part of each implementation.  **Task 3.2 Diagnostic survey.** This will be done across study sites to capture farmers’ perceptions onmaincauses of soil erosion**,** identify existing farmers’ initiatives and setting pace for sound control measures. The study will be undertaken using multi-disciplinary team mainly composed of soil and land management experts, sociologist among others.  **Task 3.3. Soil and water conservation**. Activities will be done at landscape levels focusing on the following sub- tasks.  **Sub task 3.3.1. Soil erosion management technologies**. The study will focus on runoff management namely, increasing water intake and storage, control of water movement and safe disposal of excess rainfall as runoff. We will evaluate the efficacy of technologies such as strip cropping and contour bunds, that can minimize the runoff volume and velocity across study sites. In addition to controlling erosion, these technologies are known to improve soil moisture availability to rooting zone, cereals yields, and enhance rainwater use efficiency (RUE) in semi-arid areas. The contour bands and ridges will be reinforced with leguminous shrubs and relevant bush species and elephant grass. In order to integrate livestock into the system, fodder grass or tree/shrubs species will be planted on the soil erosion control structures and evaluated along with other livestock based intervention detailed in WP 5. Participatory approaches to minimize erosion will be evaluated on at least two villages during 2012/2013 cropping season. To this end, action research aimed at enhancing resilience of maize-based farming systems in Kiteto and Kongwa districts will be conducted at both Africa RISING and NAFAKA sites to introduce both mechanical and biological soil erosion control measures as a sound strategies for reversing the adverse effects of land degradation mainly caused by uncontrolled runoff.  **Sub task 3.3.2. In-situ rainwater harvesting technologies.** In semi-arid zones of Tanzania crops are grown in stressful environments characterised by unpredictable soil water supply, high temperature, high evaporation and limited growing season length (3-4 months) (Hatibu *et al*., 1995[[11]](#footnote-11)). Moreover, when there it rains, the limited soil cover and poor land management systems lead to high water loss through runoff (Swai *et al.,* 2007[[12]](#footnote-12)). Prediction models estimate that areas with uni-modal rainfall patterns of Tanzania will experience decreased rainfall of 5% to 15%. Thus over dependence on agriculture, low and unreliable rainfall, poverty and high livestock numbers, justify the considerations of Rainwater Harvesting (RWH) in in the semi-arid areas of Tanzania (Senkondo *et al.,* 2004[[13]](#footnote-13)). This study will examine best bet technologies for enhancing infiltration capacity and soil transmission characteristics using *in situ* rain water harvesting strategies such as ripping, ridging, and conventional tillage technologies. Depending on the source of farm power either tractor or oxen based equipment will be used.  **Sub task 3.3.2. Soil water management technologies**. Activities will include *in-situ* rainwater harvesting technologies such as ripping, ridging, and conventional tillage. Action research on these interventions including use of improved cereal and legumes species/crops will be conducted at both NAFAKA and new action sites.  **Sub task. 3.3.3** **Cost benefits analyses**. This will be done to support promotional activities. It will also include design of practical measures to support use of soils and water management strategies. |
| **Deliverables**   1. Best bet soil water conservation technologies validated for up-scaling. 2. Reduced land degradation and better land productivity among farmers in NAFAKA and other target operational areas. 3. Strategies for improve soils and water management will be developed and readied for up and out-scaling. 4. Cost benefits for soils and water management will be determined to support up and out-scaling activities. |

## Work package 4. Post harvest processing, utilization and nutrition

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| **Work package number** | **WP 4** | **Start date or starting event:** | | | |  | | |
| **Work package title** | Post harvest processing, utilization and nutrition | | | | | | | |
| **Activity Type** | R&D, R&T, participatory and promotional action | | | | | | | |
| **Target areas (Districts- Villages** | Chitego | Laikala | | Mlali | Moleti | Njoro | |  |
| **WP leader** | ICRISAT | | | | | | | |
| **Partners** | ARI-Hombolo | | SUA | CIMMYT | Tuboreshe Chakula | | IITA | |
| **WP budget** | 45,542 | | | | | | | |

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| **Relevant Africa Rising Objective: Objective 2 on Integrated systems improvement** |
| **Key intervention areas:**   * **Household nutrition**. Increase food security and improved household nutrition among the most vulnerable households especially women and children. * **Gender empowerment**. Realize the special opportunities available to women farmers as technical innovators, resource managers and homemakers. |

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| **Description of work**  **Task 4.1 Competitiveness of pigeon pea as alternative protein crop studied.** Various products from Pigeon pea will be evaluated for replacement in human food especially compound flours as replacement products for soybeans the major course currently in use.  **Subtask** **4.1.1** **Product development**: Focal activities will include development of pigeon pea and cereal based compound flours.  **Subtask 4.1.2.** **Cost benefits analysis**. Socioeconomic studies focusing on cost benefits of pigeon pea as a replacement product of soy will be conducted to underpin promotional work in year 2.  **Subtask 3**. **Adoption studies**. Studies for enhanced nutrient compound foods and nutrient supplements will be conducted in target communities to guide deployment of new products and how best integration of the new products within the food systems should be done within the communities.  **Task 4.2. Food safety.** The aim of this action is to minimize the extent of food contamination especially bymycotoxins. The mycotoxin aflatoxin is one of the major concerns associated with groundnuts and affects food safety at household level as well as for trade. Thefocuswill be on Aflatoxin a mycotoxin commonly associated with production areas experiencing end of season drought such as semi-arid zones. We will study the extent of the problem on maize, groundnuts pigeon pea, common beans, bambara nuts and sorghum. These crops are the common staples in the semiarid zones of Tanzania we are working in. This action will be implemented in partnership with relevant ARI and other associate partners who will be contacted in course of the project.  **Subtask 4.2.1.** Profile value chain of selected food crops to identify contamination points to be targeted for management and control strategies  **Subtask 4.2.2.** Assess the extent of the problem **(**mycotoxins**)** on selected crops  **Subtask 4.2.3.** Awareness raising using control existing materials working with various partners  **Subtask 4.2.4.** Develop a sampling strategy for year two risk exposure studies and mitigation efforts  **Task 4.3 Household nutrition based on cereals.** This task aims at improve nutrition of households especially protein. Quality protein maize (QPM) varieties released in Tanzania will be evaluated at experimental level at test sites for adaptability as part of a first step to underpin its promotion in the target communities. This work will be led by CIMMYT in partnership with Tanseed International. Efforts to evaluate pro-vitamin A maize will be made and tested for adaptability in target areas in partnerships with ARI and national partners. |
| **Deliverables**   1. Pigeon pea as alternative protein crop studied 2. Aflatoxin on maize Groundnuts, Pigeon pea, Bean bambara nuts & sorghum investigated 3. Farmers sensitized on extent of contamination as well as the health hazards associated with aflatoxin contamination. 4. Profile value chain for contamination points to target management strategies. |

## Work package 5. Crop livestock and poultry integration and productivity enhancement

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| **Work package number** | **WP 5** | **Start date or starting event:** | | |  | | |
| **Work package title** | Crop/Tree livestock and poultry integration and productivity enhancement | | | | | | |
| **Activity Type** | Action research type, participatory and promotional action | | | | | | |
| **Target areas (Districts- Villages** | Chitego | Laikala | Mlali | Moleti | Njoro | |  |
| **WP leader** | ICRAF | | | | | | |
| **Partners** | UDOM | Pasture Research Center Kongwa |  | | |  | |
| **WP budget (USD)** | 19, 614 | | | | | | |

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| **Relevant Africa Rising Objective: Objective 2 on Integrated systems improvement** |
| **Key intervention areas:**   * **Resource conservation**. Protect land and water resources and foster agricultural biodiversity through the introduction and management of physical and biological measures. * **Improved household nutrition**. Increase food security and improve household nutrition among the most vulnerable households and their members, especially women and children. * **Gender empowerment**. Realize the special opportunities available to women farmers as technical innovators, resource managers and homemakers. |

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| **Description of work**  **Task 5.1.** **Community mobilization for the action.** The aim of this activity is to prepare the communities in the two districts to engage in the action. The following activities will be done. Farmers will be sensitized and those willing will be engaged in the proposed tasks as part of Land improvement programme. Gender dimensions and impacts of land tenure on adoption of the proposed technologies will be part of each implementation.  **Task 5.2. Integrated Tree/crop-livestock productivity enhancement.** Main issues related to livestock and poultry in the target districts include inadequate supply of quality feeds and accelerated land degradation due to poor management and high stocking levels. Thus, this WP will focus on testing and scaling out various interventions for addressing these problems. Initial activities related to the feeds problem will be to characterize and prioritize existing forage and pasture tree/shrub and grass species. This will involve conducting literature and field surveys to identify key forage and pasture species and collecting samples for assessing biomass and forage quality during wet and dry seasons to capture seasonal variability in quantity and quality of feeds. Because of the late start of fieldwork, only the dry season assessment will be conducted in 2013. Information from this activity will be used to prioritize best-bet species for propagation to get planting materials for farmers and for studies on feeds management and utilization in year 3 (2014) and beyond. The characterization will involve literature review to collect available information, especially for the fast growing introduced fodder tree species like *Gliricia sepium* and *Leucaena diversifolia* which have been widely studied. In contrast, information on indigenous and locally adapted forage and pasture tree/shrubs and/or grass species in semi-arid areas is scanty because not much research has been conducted on these species. Thus, samples of indigenous tree/shrubs species such as *Acacia* spp and grass species will be collected for biochemical analysis to determine high quality sources of fodder and pasture in targeted sites. This characterization work will be complemented with livestock and poultry need assessment baseline survey (livestock and poultry baseline study) so as to design future interventions. It is expected that information from characterization of forage and pasture species and the feeds baseline survey will be used to select species that can be integrated in farming and grazing systems to improve production of high quality forage and pasture species while addressing soil fertility and soil erosion as detailed below. This scaling up activity will be preceded by community mobilization and capacity building for propagation of best-best forage and pasture species, and studies on feeds management and utilization options of the best-best tree/shrub and grass species. This research will involve making livestock and poultry feeds supplements (leaf meals and cakes) and establishing feeding trials to examine the effects of these supplements on livestock and/or poultry growth and productivity (biomass, milk and eggs production). As part of capacity building, efforts will be made to demonstrate at community and household level how to raise tree seedlings in the nursery, plant tree in the field and homestead and make feeds supplements. Farmers will be encouraged to form groups to receive relevant trainings on tree nursery and livestock and poultry feeds management as well as planting materials (seeds, cuttings or seedlings). It is expected that community mobilization and propagation activities will be completed by December 2013 while feeding trials will be established in year 3 (2014) and capacity building will be a continuous activity thought the implementation period.  Appropriate integration of fodder trees/shrubs and grasses species in farming and grazing systems can help to minimize the land degradation and feeds supply problems by reducing erosion and producing high quality feeds. Hence various options at a farm and landscape levels will be tested to integrate forage and pasture species in these systems. This include the use of tree/shrub and grass species for stabilizing soil and water conservation structures, like contours bands, planting of tree/shrubs species in boundaries and as wind breaks to reduce soil and water erosion, and woodlot planting. Elephant grasses are already used in Njoro village in Kiteto (one of the targeted sites) to stabilize soil and water conservation structures. This WP will build on such efforts to increase the choice of fodder grass and tree/shrub species for use and scale-out in other sites. One of the main challenges for planting fodder trees and grasses in the fields is the high grazing pressures during off seasons in targeted sites. However, fresh leaves of *G. sepium* are not readily eaten by livestock unless they get used to the smell of the leaves. Hence strips of double rows of this species will be planted in the field at 50-m apart to reduce wind and water erosion. Once established the shrub may be used a nurse tree for other tree/shrub species (e.g. *Melia azedarach*, *Tamarindus indica*), which can be planted within the windbreak strips to reduce soil and water erosion while supplying other benefits like producing food and wood products (fruits, fuelwood and timber). Activities under this WP will be carried out in partnership with livestock feeds specialist from the Pasture Research Centre (PRC) Kongwa-Tanzania and the tree fodder expert from the University of Dodoma.  **Task 5.3**. **Poultry feeds/production.** Researchon poultry feeds management (making feeds supplement and conducting feeding trials) will be carried out concurrently with livestock feeds as detailed in Task 5.2. In addition, opportunities for utilizing poultry wastes for fish farming in small ponds and/or vegetable gardening will be explored from year 3 (2014) and beyond. |
| **Deliverables**   1. Capacity of farmers in livestock and poultry feeds management and utilization strengthened to support the proposed interventions in these areas in 2014 and beyond 2. Nutritional quality of indigenous forage and pasture species determined to guide the selection of appropriate species for inclusion in local fodder and pasture management systems. 3. Identification of appropriate fodder trees and shrubs for integration in maize-based farming systems as part of sustainable land (soil and water conservation) management options 4. Propagation of best-bet forage and pasture species to supply the planting materials for the 2014 growing season |

## Work package 6. Characterization of Africa RISING sites

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Work package number** | **WP 6** | **Start date or starting event:** | | | | | November 2012 to September 2013 | | |
| **Work package title** | Characterization of Africa RISING sites | | | | | | | | |
| **Activity Type** | Action research type, participatory and promotional action | | | | | | | | |
| **Target areas (Districts- Villages** | Chitego | | Mlali | | Moleti | Njoro |  |  |  |
| **WP leader** | ICRAF | | | | | | | | |
| **Partners** | ARI-Hombolo | | | SUA |  | | | | |
| **WP budget (USD)** | 28,020 | | | | | | | | |

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| **Relevant Africa Rising Objective: Objective 1 on Situation Analysis (biophysical baselines)** |
| **Key intervention areas:**  **Resource conservation**. Conservation of the natural resource base, especially soils, needed to support SI options. |

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| **Description of work**  **Task 6.1.** **Community mobilization for the action.** The aim of this activity is to prepare the communities in the two districts to engage in the action. The following activities will be done. Farmers willing will be engaged to develop an action map related to livestock/ crop integration as part of Land improvement programme. The sensitization meetings will be done with the help of village leadership, NAFAKA, DALDOs and ARI. Gender dimensions and impacts of land tenure on adoption of the proposed technologies will be part of each implementation.  **Sub task. 6.2 Site Characterization.** This WP will focus on conducting biophysical baselines at landscape and farm levels to provide data for assessment of tested technologies in targeted areas. The land degradation surveillance framework (LDSF) will be used for biophysical characterization of the Africa RISING sites will also be explored. LDSF is a spatially stratified, hierarchical, randomized sampling framework that captures information ranging from soils, vegetation structure and terrain characteristics based on sentinel sites consisting of 10 x 10 km sampling units. (Vagen et al., 2012). Across each 100-km2 site, 160 plots will be sampled. Farm/plot level analyses of initial soil conditions will be conducted for all trials in other work packages to provide field-level soil condition associated with the tested technologies. The farm-level site characterization is a crosscutting activity, which will be implemented in collaboration with other WP leaders. This work will involve collecting soil samples from the mother plots for routine analysis to characterize the initial condition of the site. |
| **Deliverables**   1. Baseline report highlighting soil conditions and major constraints to SI in targeted areas 2. Initial site condition of field sites targeted for on-farm trials evaluated and documented for M&E and impacts assessment |

**Work package 7. Lesson learning, networking and coordination**

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| --- | --- | --- | --- | --- | --- | --- |
| **Work package number** | **WP 7** | **Start date or starting event:** | | | | November 2012 to September 2013 |
| **Work package title** | Lesson learning, networking and coordination | | | | | |
| **Activity Type** | Action research type, participatory and promotional action | | | | | |
| **Target areas (Districts- Villages** | Chitego | | Laikala | Mlali | Moleti | Mvugala |
| **WP leader** | ICRISAT | | | | | |
| **Partners** | All Partners | | | | | |
| **Total budget (USD)** | 10, 141 | | | | | |

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| **Relevant Africa Rising Objective: Objective 4 on Monitoring and Evaluation** |
| **Key intervention areas:** This WP will speak to the management, coordination, as well as lesson capture during implementation for up and out scaling purposes. |

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| **Description of work**  **Task 7.1. Develop communication strategy**  The Project will at the onset, develop a simple communication strategy. The Strategy will identify the key audiences that will benefit from the lessons that are expected to emerge from the Project, clarify on process for developing messages for each of the different audiences identified. The plan will also clarify on the different communication products to be developed. From the onset, the Project will produce communication products such as policy briefs, synthesis reports and companion summaries; pull-up stands for exhibitions, flyers and PowerPoint presentations.  **Task. 7.2 Networking** **and coordination**. The project will be coordinated by ICRISAT but respective leaders will lead all work packages. The action is underpinned by the need to share lessons across the partners in implementing districts and with other Africa RISING programme actors. Through this WP we will work with the other partners to develop an online repository for information, publications and documents form the project. The site will establish links with other relevant sites across the Africa RISING programme. In addition, publications and other outputs from this Action will be made available through the site. A discussion platform and information interphase will also be established to improve information.  **Task. 7.3 Assessment of technologies and lessons learnt.** Two activities will be conducted (1), An intermediate assessment of success of interventions deployed in the target districts will be conducted. This will done by the ICRISAT be led socio-economists in conjunction with ICRAFT socio-economists and IFPRI team. The team will design studies and collectively work out its implementation. This particular study will be done alongside with cots benefits analysis of WP 2 and 3. (2) A lessons learnt workshop involving project partners will be held at the end of the second year to identify lessons, and emerging issues from the project also identified in the technology diffusion studies described in (1) of this work package. It is estimated that about 25 participants will attend the workshop. |
| **Deliverables**   1. Effective communication tools developed and used to promote project interventions as well as interphase with diverse stakeholders. 2. Benefits of technologies to target communities and their suitability for intensification purposes validated. 3. Lessons for scaling up and out of the project capture and documented for roll out activities using appropriate tools developed by the project. |

# 4. PARTNERSHIPS

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| **Nature of Partner and Institutional Affiliation** | **Role in Project** |
| **Core Partners** | |
| ICRISAT | Coordinate the project and lead WP 1, 4, 7 focusing in intensifying production of cereal and legumes. ICRISAT is a leader in R&D of legumes and cereals for semi arid tropics |
| CYMMIT | Lead activities in that involve maize and its products. In this project CIMMYT will participate in WP 1, 2 and 4. CIMMYT is a global leader in maize R&D and in this project lead maize R7D activities |
| ICRAF | Lead activities in that involve natural resources management In this project ICRAF will participate in WP 1, 2 and 4. ICRAF is a leader in R&D agroforestry and natural resources management and will lead and or support these actions in the project. |
| ARI- Hombolo | ARI Hombolo is the NARI in the Africa RISING target regions of Tanzania. In this project ARI will be involved in all project activities but will particularly lead WP 3. |
| **Non Core Partners** | |
| ARI- Naliendele | ARI Naliendele is the NARI with mandate to lead groundnuts research in Tanzania. In this project ARI- Naliendele will be involved in all project activities focusing on use of groundnuts based technologies especially WP 1. |
| UDOM | Will participate in WP 5. Livestock feeds specialists from this institutional will engage in feds and pasture analysis |
| Pasture Research Centre Kongwa | Will participate in WP 5. Livestock feeds specialists from this institutional will engage in feds and pasture analysis |
| SUA | SUA is the leading agricultural and natural resources University in Tanzania. It will engage in WP 1,2,3,4,6 engaging in both R^D and capacity building |
| NAFAKA | Tanzania Staples Value Chain (NAFAKA) is a USAID-funded program that integrates agricultural, gender and nutritional development approaches to improve smallholder farmers’ productivity and profitability in maize and rice value chains. In this project NAFAKA sites will provide complementary and where applicable sites for learning and scaling up of interventions |

# 5. PROJECT GANTT CHART

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Work Package** | **Summary of activities** | **Begin** | **End** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** | **Oct** | **Nov** |
| **WP 1** | **Onfarm evaluations** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 1.1 Community Mobilization | 1-Nov | 30-Nov |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 1.1.1 Site and farmer selection | 1-Nov | 30-Nov |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 1.2 Maize | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 1.2.1 Stress tolerance | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 1.2.2 QPM | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 1.3 Legumes | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 1.3.1 Pigeon pea | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 1.3.2 Groundnuts | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 1.3.1 Seed systems | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **WP 2** | **Integrated soil fertility management** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 2.1 Community Mobilization | 1-Nov | 30-Nov |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 2.1.1 Site and farmer selection | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 2.2 Improving fertilizer application | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 2.3 Efficient nutrient use | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 2.3.1 Improving perception on fertilizers | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 2.3.1 Evaluating intercropping | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 2.3.1 Cost benefit analysis | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **WP 3** | **Land management** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 3.1 Comm. Mobilization | 1-Nov | 30-Nov |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 3.1.1 Site and farmer selection | 1-Nov | 30-Nov |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 3.2 Soil and water conservation | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 3.2.1 Soil erosion management | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 3.2.2 Soil water management technologies | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 3 2.3 Cost benefit analysis | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **WP 4** | **Post harvest handling and Nutrition** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 4.1 Appropriate technology for storage | Apr-12 | 30-Oct |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 4.2 Processing and Utilization of legumes | Apr-12 | 30-Oct |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 4.2.1 Processing and Utilization of pegion pea | Apr-12 | 30-Oct |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 4.2.2 Processing and Utilization of groundnuts | Apr-12 | 30-Oct |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 4.3 Food safety | Apr-12 | 30-Oct |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 4.4 Household nutrition based on cereals | Apr-12 | 30-Oct |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **WP 5** | **Crop livestock integration** | Apr-12 | 30-Oct |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 5.1 Community Mobilization | Apr-12 | 30-Oct |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 5.2 Integrated crop/livestock productivity | Apr-12 | 30-Oct |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 5.3 Poultry feeds and production | Apr-12 | 30-Oct |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **WP 6** | **Characterisation of Sites** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 6.1 Community Mobilization | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 6.2 Site Characterisation | Nov-31 | 31-May |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **WP 7** | **Lesson learning and coordination** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 7.1 Communication Strategy development | Nov-31 | 28-Feb |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 7.2 Networking and Coordination | Nov-31 | Nov-31 |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Task 7.3 Lesson learning | 30-Oct | Nov-31 |  |  |  |  |  |  |  |  |  |  |  |  |  |

**6. BUDGETS**

**6.1 Summary Budget**

|  |  |  |
| --- | --- | --- |
| **Budget lines** | **Summary of activities** | **Budgeted cost USD** |
| **1. Work Packages** |  |  |
| WP 1 | **On-farm evaluations** | 123609 |
| WP 2 | **Integrated soil fertility management** | 50222 |
| WP 3 | **Land management** | 37,360 |
| WP 4 | **Post harvest handling and Nutrition** | 45,542 |
| WP 5 | **Crop livestock integration** | 19,614 |
| WP 6 | **Characterisation of Sites** | 28020 |
| WP 7 | **Lesson learning and coordination** | 10,141 |
| **Sub total (research activities)** |  | **314,508** |
|  | | |
| **Support and administrative costs** |  |  |
| **2. Staffing Costs** |  | **106,476** |
| **3. Travels** |  | **19,614** |
| **4. Overheads** |  |  |
| ICRISAT | 15% | 29464 |
| ICRAF | 15% | 17508 |
| CIMMYT | 15% | 6990 |
| ARI- Hombolo | 7% | 4463 |
| Other NARS | 7% | 1196 |
| **Subtotal Support and Admin costs** |  | **59622** |
| **Grand total (sum of subtotals)** |  | **500,220** |

**6.2 Budgetary allocations per institutions (USD)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Institution | **Research** | **Human resource** | **Total** | **Overhead** | **Grand total** | **% Distribution** |
| ICRISAT | 136,654 | 59,776 | 196,430 | 29,464 | 225,894 | 45 |
| ICRAF | 98,974 | 17,746 | 116,720 | 17,508 | 134,228 | 27 |
| CIMMYT | 28,853 | 17,746 | 46,599 | 6,990 | 53,589 | 11 |
| ARI Hombolo | 52,550 | 11,208 | 63,758 | 4,463 | 68,221 | 14 |
| Others NARS actors | 17,092 | 0 | 17,092 | 1,196 | 18,289 | 4 |
| **Totals** | **334,123** | **106,476** | **440,599** | **59,622** | **500,220** | **100** |

**Notes**

1. 18% of the research budget will go directly to national institutions
2. ICRISAT will manage all costs of human resource costs to be recruited at national level. Thus 21% of human resource costs will be spent at national level
3. Operational costs (research, transport and communication) are all embedded with research cost for this table.

**APPENDIX 1. DETAILED BUDGET**

|  |  |  |
| --- | --- | --- |
| **1. R&D Budget** |  |  |
| **Work Package** | **Summary of activities** | **Budgeted Cost (USD)** |
| WP 1 | **On-farm evaluations** |  |
|  | Task 1.1 Community mobilization | 2802 |
|  | Task 1.1.1 Site and farmer selection |  |
|  | Task 1.2 Maize | 27303 |
|  | Task 1.2.1 Stress tolerance |  |
|  | Task 1.2.2 QPM |  |
|  | Task 1.3 Legumes |  |
|  | Task 1.3.1 Pigeonpea | 23402 |
|  | Task 1.3.2 Groundnuts | 23402 |
|  | Task 1.3.1 Seed systems | 46700 |
| **Subtotal** |  | **123609** |
| WP 2 | **Integrated soil fertility management** |  |
|  | Task 2.1 Community mobilization | 2802 |
|  | Task 2.1.1 Site and farmer selection |  |
|  | Task 2.2 Improving fertilizer application |  |
|  | Task 2.3 Efficient nutrient use | 23402 |
|  | Task 2.3.1 Improving perception on fertilizers | 4680 |
|  | Task 2.3.1 Evaluating intercropping | 15602 |
|  | Task 2.3.1 Cost benefit analysis | 3736 |
| **Subtotal** |  | **50222** |
| WP 3 | **Land management** |  |
|  | Task 3.1 Community mobilization | 2802 |
|  | Task 3.1.1 Site and farmer selection |  |
|  | Task 3.2 Soil and water conservation |  |
|  | Task 3.2.1 Soil erosion management | 15602 |
|  | Task 3.2.2 Soil water management technologies | 23402 |
|  | Task 3 2.3 Cost benefit analysis | 3736 |
| **Subtotal** |  | **45542** |
| WP 4 | **Post harvest handling and Nutrition** |  |
|  | Task 4.1 Appropriate technology for storage | 7472 |
|  | Task 4.2 Processing and utilization of legumes |  |
|  | Task 4.2.1 Processing and utilization of Pigeonpea | 7472 |
|  | Task 4.2.2 Processing and utilization of groundnuts | 7472 |
|  | Task 4.3 Food safety | 7472 |
|  | Task 4.4 Household nutrition based on cereals | 7472 |
| **Subtotal** |  | **37360** |
| WP 5 | **Crop livestock integration** | 0 |
|  | Task 5.1 Community mobilization | 2802 |
|  | Task 5.2 Integrated crop/livestock productivity | 7472 |
|  | Task 5.3 Poultry feeds and production | 9340 |
| **Subtotal** |  | **19614** |
| WP 6 | **Characterisation of Sites** |  |
|  | Task 6.1 Community mobilization |  |
|  | Task 6.2 Site Characterisation | 28020 |
| **Subtotal** |  | **28020** |
| WP 7 | **Lesson learning and coordination** |  |
|  | Task 7.1 Communication strategy development | 1560 |
|  | Task 7.2 Networking and coordination | 3120 |
|  | Task 7.3 Lesson learning | 5461 |
| **Subtotal** |  | **10141** |
|  |  |  |
| **Total Research Activities** |  | **314508** |
|  |  |  |
| **2. Personnel Costs** |  |  |
| **2.1 Senior scientists** |  |  |
| Staff-Time Coordinator | Coordination | 22416 |
| Staff-Time ICRISAT | Research activities | 14944 |
| Staff-Time CIMMYT | Research Activities | 17746 |
| Staff-Time ICRAF | Research Activities | 17746 |
| Partner ARI- Hombolo | Research Activities | 11208 |
| **Subtotal (A)** |  | **84060** |
|  |  |  |
| **2.2 Support staff** |  |  |
| Field Research Officer |  | 5604 |
| Res Assistants |  |  |
| WP 1 | 2 | 6725 |
| WP 2,3 | 1 | 3362 |
| WP 4,5 | 1 | 3362 |
| Driver | 1 | 3362 |
| **Subtotal (B)** |  | **22416** |
|  |  |  |
| **Total Personnel** |  | **106476** |
|  |  |  |
| **3 Travels** |  |  |
| 3.2 Travel national |  | 11208 |
| 3.3 Travel International |  | 8406 |
| **Subtotal** |  | **19614** |
|  |  |  |
| **4. Overheads** |  |  |
| ICRISAT | 15% | 29464 |
| ICRAF | 15% | 17508 |
| CIMMYT | 15% | 6990 |
| ARI- Hombolo | 7% | 4463 |
| Other NARS | 7% | 1196 |
| **Subtotal** |  | **59622** |
|  |  |  |
| **Grand total** |  | **500220** |

**Budgetary Notes:**

**1. Personnel Costs**

Costs for CGIAR are based on a unit cost of 160,000 USD per year. The costs are broken down into

1. Coordinator costs= 14% staff time = 160,000 x.15= 22,416 USD
2. Scientist time =Ca 11% staff time = 16,0000 x .11= 17746
3. National staff = 934 USD per month = 11208 USD pre year

**2. Overheads**

These are charged as indicated in the detailed budget

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